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No clinically relevant effects in children after accidental ingestion of *Panaeolina foenisecii* (lawn mower’s mushroom)

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**ABSTRACT**

Introduction: *Panaeolina foenisecii* is one of the most common and widely distributed lawn mushrooms in Europe and North America, and frequently involved in accidental mushroom ingestion, mainly in children. Nevertheless, there is contradictory information regarding the toxicity profile of *P. foenisecii* in the literature. Objective of the study was to assess clinical effects with particular attention on psychotropic properties of *P. foenisecii* in case of accidental oral exposure.

Methods: This observational case series is based on prospectively collected data on mushroom poisoning using a structured data collection form, and it was performed in seven poisons centres in Germany and Switzerland. Inclusion criteria were accidental ingestion of at least one cap of *P. foenisecii* identified by a mycologist, and a follow up of at least 4 hours.

Results: Nineteen cases met all inclusion criteria, and only children were involved with a mean age of 3 years. They ingested 1–2 mushrooms in 14 cases and 3–5 mushrooms in five cases. Three patients received a single dose of activated charcoal. Sixteen out of 19 cases did not develop any symptoms, 2/19 complained of minor abdominal discomfort. One child was temporarily mildly hyperactive, and this was the only patient observed in a hospital for 12 hours. None of the children showed signs of hallucinations.

Conclusions: This multicentre study demonstrates that the typically small amounts of *P. foenisecii* ingested by children probably do not lead to clinically significant symptoms.

**Introduction**

Mushrooms of the species *Panaeolina foenisecii* (Syn. *Panaeolus foenisecii*, lawn mower’s mushroom, brown hay cap) are one of the most common and widely distributed lawn mushrooms in Europe and North America, and they often fruit in large numbers [1]. The cap is 0.8–2.5 cm in diameter, pale reddish brown and strongly hygrophanous, the gills are mottled with white edges. The spores are dark purple brown (Figure 1). As lawn mushrooms represent the main fungal species in accidental pediatric mushroom ingestion [2,3], *P. foenisecii* is likely to be frequently involved. Furthermore, lawn mushroom ingestion is also reported in adults, but rarely [4]. There is a paucity of information regarding the risk of poisoning following unintentional ingestions of *P. foenisecii*. In toxicological textbooks [5] and in popular mushroom fieldguides [6] *P. foenisecii* is alleged to exhibit hallucinogenic properties. Chemical analysis on its content of psilocybin revealed inconsistent results, detecting psilocybin in low concentrations in some collections from North America [7] and no psilocybin in other, foremost European collections [8,9]. Based on this controversy and the lack of clinical information of *P. foenisecii* poisoning, a working group of the Gesellschaft für klinische Toxikologie (GfKT, Society for Clinical Toxicology) conducted a prospective multicentre data collection over a period of four years to investigate the clinical features with particular attention to possible hallucinogenic effects after accidental ingestion of *P. foenisecii* growing in Central Europe (Germany, Switzerland).

**Methods**

**Study design and data acquisition**

From May 2010 to December 2013, a prospective, observational, non-comparative study on accidental *P. foenisecii* exposures in adults and children was conducted. This analysis was based on a database operated by a working group of the GfKT, designed to elucidate toxicity of mushrooms of unknown toxicity. Seven GfKT Poisons Information Centres...
(PIC) from Germany and Switzerland participated in this study. All these PIC provide 24-h 7-days-a-week nationwide medical advice to health professionals and the general public. Demographic and detailed clinical information on exposure cases, age (children <16 years) and gender, circumstances of exposure, ingested quantities, parts of the mushroom, clinical features, and therapeutic measures were entered by the participating PIC into a common database using a structured and anonymised data collection form. These data were analysed retrospectively.

**Mushroom identification procedures**

A national registry of mycologists willing to identify a mushroom specimen at very short notice is available to each poison centre. In Switzerland, the registry is online and available to the general public, in Germany the registry is only available to the poison centres staff. Callers are advised to call the mycologists using the phone numbers given by the poison centres staff or as indicated online. Arrangements for transport and identification of the mushroom specimen are made individually between the caller and the mycologist. Mycologists are asked to call the poison centres to provide the scientific name of the identified mushroom species.

**Data classification**

Evaluation of severity and causality was performed by an experienced clinical toxicologist. Additionally, all cases included in the study have been reviewed in detail by the first author.

The severity of symptoms was graded in accordance with the Poisoning Severity Score (PSS), which has been developed by the European Association of Poisons Centres and Clinical Toxicologists, as “minor”, for mild, transient and spontaneously resolving symptoms/signs; “moderate”, if at least one pronounced or prolonged symptom/sign was recorded; “severe”, if at least one severe or life-threatening symptom/sign was observed or “fatal”, if the poisoning was the recorded cause of death [10].

**Inclusion and exclusion criteria**

The following criteria had to be met for reported cases to be included in the study:

- Adults: reliable report of accidental ingestion of at least one cap of *P. foenisecii*.
- Children: accidental ingestion of at least one cap of *P. foenisecii*, witnessed by caregivers.
- On-site mycological identification, either by leftovers of the ingested mushrooms or by identification of identical specimens grown at the same site by a certified mycologist. Microscopic confirmation was not mandatory.
- Follow-up for at least four hours after ingestion (Follow-up telephone call by a poison centre specialist or written medical feedback by the treating physician).
- Likely causal relationship between exposure and clinical effect. Causality assessment was based on a clear temporal relationship between mushroom ingestion and symptoms, absence of other drugs or diseases that could explain the symptoms. Since these criteria could not be used for asymptomatic patients, these cases were judged according to the mycological identification in combination with certainty of exposure.

Exclusion criteria included:

- Only suspicion of mushroom ingestion.
- Identification of the mushroom by photograph.
- Patient lost to follow-up.
- Ingestion of less than one cap of the mushroom.

**Ethics approval**

The study has been approved by the Cantonal Ethics Committee (Zurich, Switzerland; KEK-ZH-Nr. 2010-0302). German Ethics Committees stated that according to current German regulations approval was not necessary. Patient or parental consent was obtained for all the cases, and the study has therefore been performed in accordance with ethical standards.

**Results**

During the study period, 24 cases of exposure with *P. foenisecii* were recorded. Five cases were excluded because of insufficient identification of the mushroom (*n* = 1), or lacking follow-up information (*n* = 4). Nineteen cases met all inclusion criteria, all of them were previously healthy children: 10 females and 9 males with a mean age of 3 years (average: 3 years and 8 months, range: 1–10 years). There were no adult cases reported. In all cases the mushrooms were found in the backyard and ingested directly on site. The PIC was contacted mainly by laypersons (*n* = 17), but also by a hospital (*n* = 1) and a pharmacy (*n* = 1) with a mean latency between ingestion and call to a PIC of 15 min (average: 34 min, range: 5–120 min). In 12 cases mycological mushroom identification was achieved within a mean of 80 min (average: 92 min,
range: 40 min to 3 h) after ingestion. In seven cases, information on the latency between ingestion and mushroom identification was not available.

Fourteen children had been observed to ingest one to two mushrooms; five children ingested three to five mushrooms. In 17 cases, the ingested quantity could be reported precisely (from “cap plus part of stipe” to four mushrooms), in two cases, the exact dose was uncertain, but was estimated as much as one to two mushrooms, or four to five mushrooms respectively. Additionally to the mandatory physical mushroom identification, a microscopic identification was performed in seven cases.

Sixteen (84%) children remained asymptomatic, and three (16%) children experienced mild symptoms: two seven-year-old children according to the parents’ reports complained of minor abdominal discomfort a few hours after ingestion of four mushrooms each, which resolved spontaneously. A girl of 1 year and 9 months developed mild hyperactivity lasting one hour after ingestion of one mushroom, but the subsequent clinical course was uneventful, and the girl was discharged home 12 hours after admission. All other children were observed at home by their caregivers. Only three children received pre-hospital gastrointestinal decontamination consisting of a single dose of activated charcoal, and all of them remained without symptoms.

None of the children showed signs of hallucinations or required a specific treatment.

Discussion

Poisons Information Centres are usually contacted in case of accidental mushroom ingestion, and a majority of these poisonings are seen in children, especially toddlers, ingesting mushrooms found in the home lawn [2]. While this can happen with any mushroom, P. foenisecii might be often implicated due to its preference for growing in large numbers in cultivated lawns. In case of accidental ingestion of non-toxic mushroom species no gastrointestinal decontamination is required [11], but because P. foenisecii is labelled as allegedly hallucinogenic [5,6], there are no commonly agreed management recommendations [3,11,12].

The aim of our study was to investigate the clinical features with special focus on hallucinogenic effects after accidental ingestion of P. foenisecii growing in Central Europe. To our knowledge, there is only one report of three young men with a history of hallucinogenic mushroom abuse experiencing hallucinations after deliberate consumption of 20–30 specimens of P. foenisecii for recreational purposes [13]. However, the mushrooms were not identified, and therefore confusion with psychedelic Panaeolus species which share the same habitat as P. foenisecii, cannot be fully excluded [14,15].

Further case reports describe symptomatic children after ingestion of P. foenisecii, all of them without hallucinations. One child developed fever [16], and another child was in a short-lasting comatose state [17], but causality was then already doubted in both cases. The third child showed red skin, and the mushroom was identified by a mycologist as P. foenisecii [18].

Furthermore, there are three large retrospective studies of accidental paediatric mushroom ingestions conducted in North America [3,19] and Ireland [18]. In a study of 82,320 unintentional paediatric mushroom ingestions, hallucinations were described only once in a 2-year-old child after exposure to an unknown mushroom [19]. In two series of 322 children [3] and 45 children [18], respectively, no hallucinations were reported after lawn mushroom ingestions. Unfortunately, not all of these studies were based on taxonomic identification [3,19].

In our case series with comparable overall circumstances of eating raw mushroom material picked in the home lawn, the same observation was made: with exception of unspecific mild symptoms in three children none of the 19 children developed hallucinations or other typical symptoms such as tachycardia, anxiety, tremor, agitation, and mydriasis that would be expected to appear within four hours after consumption of psilocybin-containing mushrooms [17].

In accordance with previous studies on lawn mushroom exposures [3,18,19], case reports on P. foenisecii exposures [18] and our study results, it appears that P. foenisecii has no clinical effects of psychoactive substances when ingested in small amounts in children. Therefore, rapid identification of the lawn mushroom would be desirable, thus avoiding unnecessary gastrointestinal decontamination procedures in case of ingestion [11]. However, caution is warranted in cases of ingestion of Panaeolus species other than P. foenisecii, which were not studied here [15].

Limitations of this study are the small number of cases, and the relatively small amounts of mushroom ingested. Unfortunately, no toxin analyses were performed. Furthermore, we might unintentionally have included cases with ingestion of other mushroom species macroscopically resembling P. foenisecii, although this is very unlikely because there is a good identification by well-trained mycologists and fungal taxonomists. Misidentification might also be possible, if the specimen gathered was not the same as the identified one, but P. foenisecii fruits often in large numbers. Theoretically, cases of P. foenisecii ingestion with symptoms might not have been reported to the poisons centres. Our results may also only apply to the geographical region of Central Europe, where the study took place. However, we assume that based on studies from other countries and continents [3,18,19], our results may also apply to other regions as well.

In conclusion, ingestion of up to five fruiting bodies of P. foenisecii from Central Europe probably does not lead to clinically significant symptoms in children. Therefore, with precise identification of the involved lawn mushroom, observation at home without gastrointestinal decontamination seems reasonable.

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The authors report no declarations of interest.

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